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CONTENTS

	PAGE	
Wyatt, I. J. The male of *Henria psalliotae* Wyatt (Diptera : Cecidomyiidae) . .	1–3,	6 figs.
Boratyński, K. A note on the species of *Asterolecanium* Targioni-Tozzetti, 1869 (Homoptera, Coccoidea, Asterolecaniidae) on oak in Britain	4–14,	7 figs.
Franciscolo, M. E. On a remarkable Mordellid beetle from Northern Rhodesia .	15–18,	11 figs.
Popham, Edward J. On the systematic position of *Hemimerus* Walker—a case for ordinal status	19–25,	5 figs.
Karabag, T. A new species of the genus *Pyrgomorphella* I. Bolivar, 1904 (Orthoptera : Acrididae) from Turkey	26–27,	5 figs.
Book Notices	28	

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THE MALE OF *HENRIA PSALLIOTAE* WYATT (DIPTERA : CECIDOMYIIDAE)

By I. J. Wyatt

(*Glasshouse Crops Research Institute, Littlehampton, Sussex*)

In February, 1958, an unknown pest of mushrooms was received from Mr. E. V. Henry, of Padstow, Cornwall. This proved to be an anomalous paedogenetic species of Cecidomyiidae.

When the female was described recently as *Henria psalliotae* Wyatt (1959)[1], the author held little hope of finding the male of the species. Paedogenetic stocks were maintained on mushroom cultures for 21 months and, although large numbers of females were obtained, no males appeared. However, on 13th November, 1959, three male flies were found, with several females, in one culture tube. It may be significant that this culture was of mushroom on a 2 per cent. malt agar slope, but had become contaminated by a *Chaetomium* sp., also acceptable to the larvae. Only a single *H. psalliotae* larva had been introduced to the culture on 28th September, 1959, so that both males and females were produced from the same genetic stock within two, or possibly three paedogenetic generations. Therefore there can be no doubt that the males belong to the same species as the holotype female.

The male closely resembles the female in most characters apart from the primary and secondary sexual differences normally encountered in Cecidomyiidae. One totally unexpected difference, however, is that the male lacks the bifid claws so prominent in the female. There is, therefore, an error in the generic description of *Henria* which is stated to have " claws distinctly bifid ". The late Dr. H. F. Barnes kindly pointed out that the claws of the female are not invariably bifid : occasionally one or both claws on a hind tarsus may be simple.

A further feature of some interest is that the distal hairs of the flagellar segments arise from prominent bosses similar to those found in many Cecidomyiinae, but, as far as is known, not encountered elsewhere in the Heteropezinae. This further confirms the impression gained from the female that the genus is intermediate between the Cecidomyiinae and Heteropezinae.

Henria psalliotae Wyatt

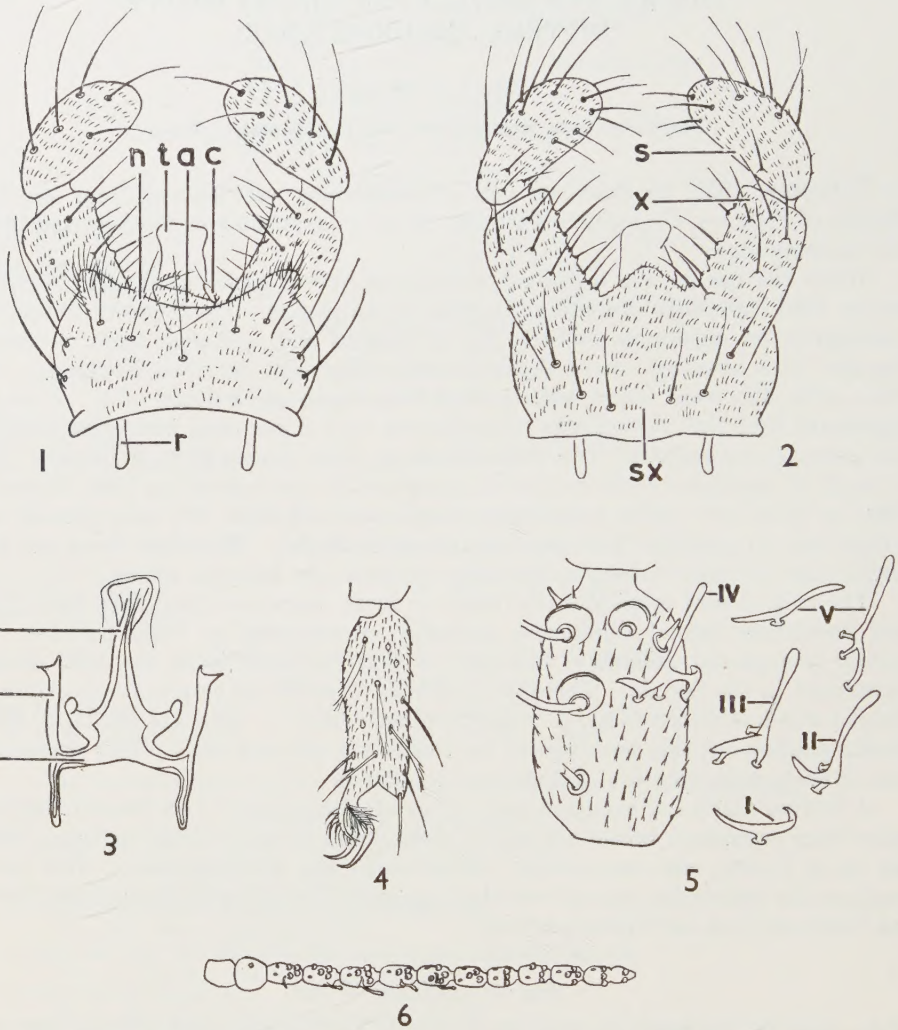
Male: resembles the female (as described by Wyatt (1959)) except in the following respects:

Head : antennae a little longer than in female, with flagellar segments cylindrical, almost twice as long as broad and diminishing in length distally except for terminal segment which is about 3 times as long as broad and apparently consisting of 2 fused segments (fig. 6); each flagellar segment with 2 or 3 proximal hairs arising normally, about 6 irregularly arranged distal hairs arising beneath large hemispherical bosses, and 2 short blunt spines distally on either side of the segment (fig. 5). Sensorium usually present medially on outer side of first 5 flagellar segments; (it is obviously a reduced form of the female ring sensorium and, though greatly variable in shape, normally consists of a long distally pointing club-shaped process attached to the segment by a few short threads, while short curved vestiges of the ring may extend around the segment (fig. 5, I–V)); on first flagellar segment, club or whole sensorium absent.

[1] Since the present paper was accepted for publication, descriptions of two North American species have been published by A. E. Pritchard (1960, *Ann. ent. Soc. Amer.* **53** : 305–16) under the new generic name *Barnesina*. However, these species so closely resemble *H. psalliotae* Wyatt that *Barnesina* must be placed as a synonym of *Henria*.

Legs : claws on all legs smooth, with no vestige of a tooth, rather abruptly curved at middle and again near apex ; empodium well developed, curved, half as long as claws ; pulvilli present as in female but with much longer fringing hairs (fig. 4).

Wings : only marginal areas and distal third of wing membrane clothed with fringed hairs, these being larger than in female.



FIGS. 1–6.—*Henria psalliotae* Wyatt : (1) dorsal view of male hypopygium ; (2) ventral view of male hypopygium ; (3) ventral view of aedeagus ; (4) terminal tarsal segment ; (5) fourth flagellar segment and (I–V) sensoria of first to fifth segments ; (6) entire antenna.

(*a*, anal segment ; *b*, bridge ; *c*, cercus ; *n*, ninth tergite ; *r*, root of coxite ; *s*, style ; *sx*, sternocoxite ; *t*, tegmen ; *x*, coxite.)

Abdomen : sternal hairs stronger than in female. Hypopygium (following terminology of Edwards (1938)) : ninth tergite well developed, twice as broad as long ; anterior margin concave, posterior margin with prominent, densely hairy processes laterally, somewhat emarginate between ; 5 long fine hairs across disc, 2 strong hairs near each lateral margin (fig. 1). Style ovoid, twice as long as broad, with scattered strong hairs mainly towards apex. Coxites parallel-sided, with numerous strong hairs mainly on inner margin, and fused ventrally into a well-developed sternocoxite having a straight anterior margin, a triangular posterior process between coxites and 6 strong hairs across disc (fig. 2) ; roots of coxites connected by a transverse bridge, forming an H-shaped structure, this bridge being broadly fused with the tapering tegmen (fig. 3) ; just

posterior to bridge, tegmen bears 2 ventrally curving lobes ; apex of tegmen spatulate ; tegmen, bridge and anterior extensions of roots of coxites incompletely tubular, that is, open ventrally. Anal segment small and apparently triangular, bearing a pair of cerci. Genital rod not discernible.

Body length : 1·1 mm., wing 0·9 mm.

England : Padstow, Cornwall, ii.1958 (*E. V. Henry*) from cultivated mushroom beds, 3 ♂, bred 13.xi.1959, from holotype stock after 21 months paedogenetic reproduction on malt agar cultures of mushroom.

Male specimen here described in the collection of the late Dr. H. F. Barnes, Rothamsted, Herts. (Cecid. 12868) ; two males in collection at G.C.R.I., Littlehampton.

Acknowledgment

I am indebted to the late Dr. H. F. Barnes for help in the preparation of this paper.

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Edwards, F. W., 1938, On the British Lestremiinae, with notes on exotic species.—1. (Diptera : Cecidomyiidae). *Proc. R. ent. Soc. Lond.* (B) **7** : 18–24.

Wyatt, I. J., 1959, A new genus and species of Cecidomyiidae (Diptera) infesting mushrooms. *Ibid.* **28** : 175–9.

A NOTE ON THE SPECIES OF *ASTEROLECANIUM* TARGIONI-TOZZETTI, 1869 (HOMOPTERA, COCCOIDEA, ASTEROLECANIIDAE) ON OAK IN BRITAIN

By K. Boratyński

(*Imperial College of Science and Technology*)

Asterolecanium variolosum (Ratzeburg, 1870) is the only oak-infesting species of the genus in the list of British insects (Kloet and Hincks, 1945 : 77), but examination of material both recently collected and in the British Museum (Nat. Hist.) shows that *A. quercicola* (Bouché, 1851) and *A. minus* Lindinger, 1912[1], also occur in Britain. It is true that the species were confused and until publication of *A classification of the scale insect genus* Asterolecanium by Russell (1941), the identity of various species described from oak in Europe was not known. Thus, there was no agreement regarding the status of Bouché's (1851) *Lecanium quercicola*, which, in fact, remained an unknown species. A species of *Asterolecanium* "redescribed" by Signoret in 1870 as *A. quercicola* (Bouché, 1851), but with Signoret's authority thereof (*A. quercicola* Signoret, 1870), was considered by Cockerell (1899), Newstead (1903), Sanders (1909) and Lindinger (1912, 1935) to be a junior synonym of *A. variolosum* (Ratzeburg, 1870) ; among some other synonyms Lindinger (*l.c.*) included also *A. variolosum minor* Leonardi, 1909, and *A. illicicola* (Targ.-Tozz., 1888), but his opinion regarding the latter species was never accepted. Leonardi (1920) recognized *A. quercicola* (Bouché) as a distinct species, but his conception of *A. variolosum* was apparently incorrect. Russell was able to establish the identity and validity of all these species ; moreover, among the misidentified material from Southern Europe she recognized and described four new species : *bellum*, *repugnans*, *roboris* and *viennae*. It should perhaps be mentioned here that the generic names *Planchonia* Signoret, 1870, *Asterodiaspis* Signoret, 1876, and *Bambusaspis* Cockerell, 1902, some of which have been used with reference to the British material and records, are accepted and confirmed by Russell as synonyms of *Asterolecanium* Targioni-Tozzetti, 1869. Russell's conclusions, conceptions of the species and their nomenclature are now generally accepted (Borchsenius, 1950 ; Ferris, 1955), and are also followed here.

Asterolecanium variolosum, *A. quercicola* and *A. minus*, though very similar, are readily separable on certain morphological characters which conform well with the general pattern of characters separating the other species within the genus. It was striking, therefore, to find that they occur together, specimens of all three species often on a single twig of the host ; they also have very similar habits and life-cycles, and all three are parthenogenetic. Thus, as is usual with closely related sympatric parthenogenetic forms, their status as species appears to be somewhat arbitrary and open to discussion and limitation. They certainly seem to be as good as any other morphological species and, until more information to the contrary is available and for

[1] The name *Asterolecanium variolosum minor* was first applied to specimens from Italy by Leonardi in 1909, but without description. Russell ascribed the authority for this species to Lindinger, who in 1912 " placed *A. variolosum minor* Leonardi, 1909, as a synonym of *variolosum*, thereby validating the name, and in doing so became the author of the variety " (Russell, 1941 : 132). This action does not appear to be necessarily correct, but being already accepted is also followed here.

convenience, they are best treated as distinct *morphological species*. Their morphological and biological relationships offer an interesting problem for detailed study, which is, however, beyond the scope of the present work.

British Records

A species of *Asterolecanium* on oak was first recorded by Douglas (1885 : 160) from Tunbridge Wells under the name of *Asterolecanium quercicola* (Bouché), and in the following year (Douglas, 1886) as *Asterodiaspis quercicola* (Bouché) from Lee and

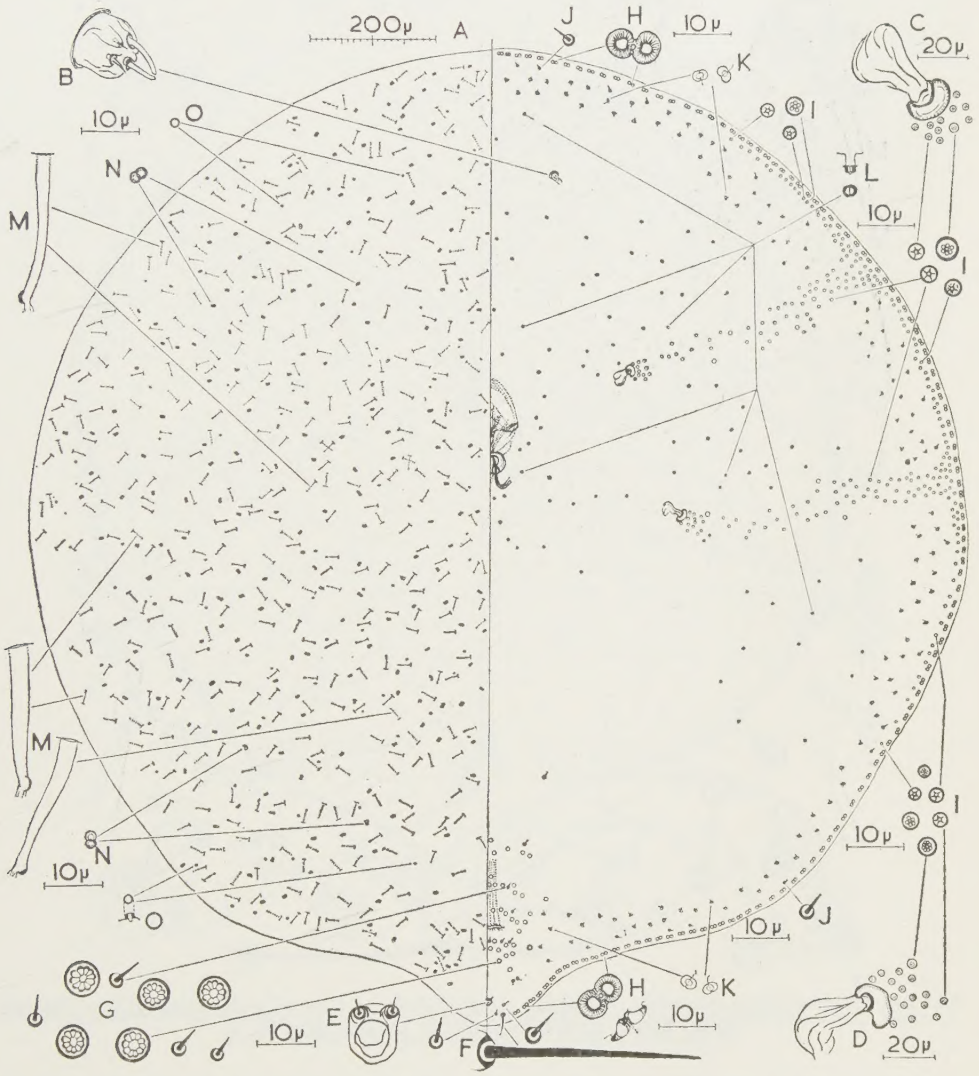


FIG. 1.—*Asterolecanium variolosum* (Ratzeburg). Adult female at time of oviposition (from Silwood Park, Berks., on *Quercus robur*).

(*A*) dorsal and ventral aspects; (*B*) antenna ; (*C*) and (*D*) anterior and posterior spiracles, respectively ; (*E*) anal ring with anal ring setae ; (*F*) apical, interapical and anteroventral setae ; (*G*) multilocular pores, and setae in perivulvar area ; (*H*) marginal 8-shaped pores ; (*I*) quinquelocular pores (marginal, and in spiracular bands) ; (*J*) submarginal ventral setae ; (*K*) submarginal ventral 8-shaped pores ; (*L*) ventral " dark rimmed " pores ; (*M*) tubular ducts; (*N*) dorsal 8-shaped pores; (*O*) dorsal simple pores. Scale line marked 200 μ refers to fig. *A* ; that marked 20 μ to figs. *C* and *D* ; and those marked 10 μ to all other details.

Eltham, London, and from Exeter. Newstead at first (1901: 34–36) also referred to the latter name but later (1903 : 156–161) described it under the name *Asterolecanium variolosum* (Ratzeburg), and recorded it from Cheshire, Flintshire, Denbighshire, Gloucestershire, Herefordshire, Hertfordshire, Norfolk, Kent and Stratford-on-Avon, the insects being abundant and common in some localities. Green listed *Asterolecanium variolosum* (Ratzeb.) in both editions of his *Brief review of the indigenous Coccidae of British Isles* (1922, 1928). British material available to Russell (*l.c.*: 219) contained

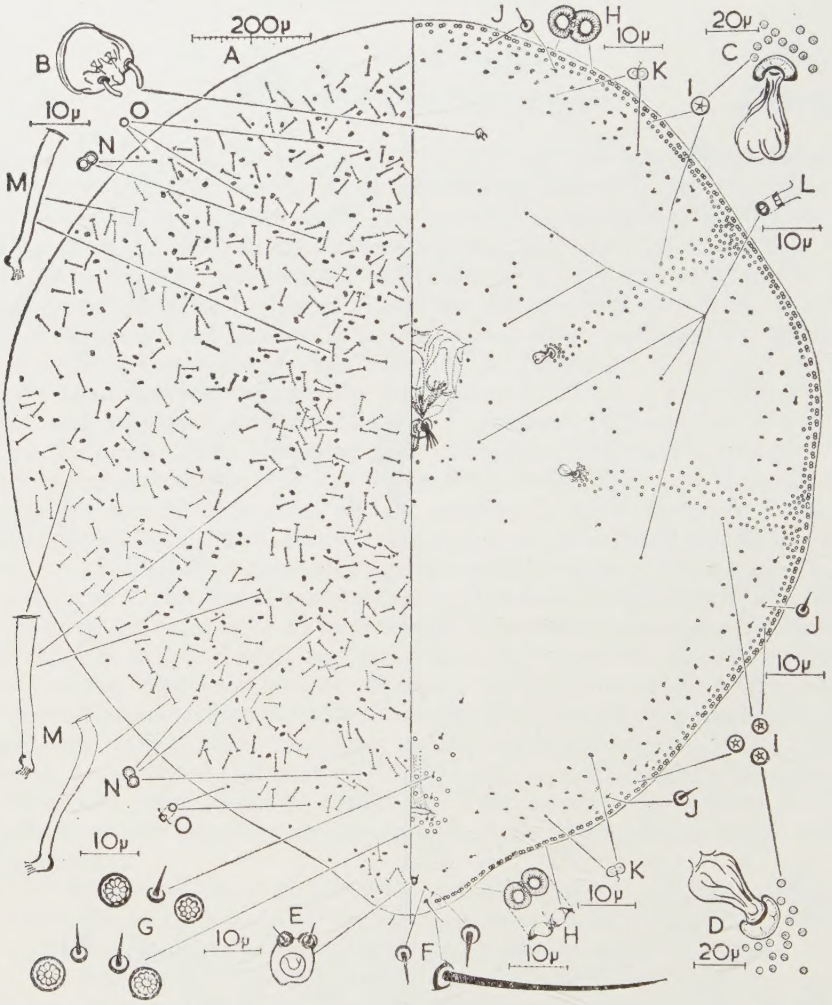


FIG. 2.—*Asterolecanium quercicola* (Bouché). Adult female at time of oviposition (from Silwood Park, Berks., on *Quercus robur*). Details as in fig. 1.

two samples of *A. variolosum*: " on *Quercus syderoxyla* (England, Newstead), and on *Q. pedunculata* (from England, intercepted at Washington, D.C., *W. B. Ward*, 1922)."

There are surprisingly few specimens preserved in the collection of the British Museum (Nat. Hist.) and it is impossible to establish to which species now recognized the earlier records refer. There are no slides with Douglas' material at all, while Newstead's and Green's specimens are contained on three and four slides, respectively, all of which are *A. quercicola* ; Russell's records indicate, however, that at least some of Newstead's material contained also *A. variolosum*. From the evidence now available

it seems highly probable that specimens of all three species have been collected but not preserved.

Material Examined

All three species have been found in abundance on *Quercus robur* L. and *Q. petraea* (Mattuschka) Liebl. growing in the grounds of the Imperial College Field Station at Silwood Park, Berks., where the biological observations were made ; about 100 adult females each of *A. minus* and *A. quercicola*, and about 50 of *A. variolosum*, as well as a number of first instar nymphs of each species, were mounted and examined. The

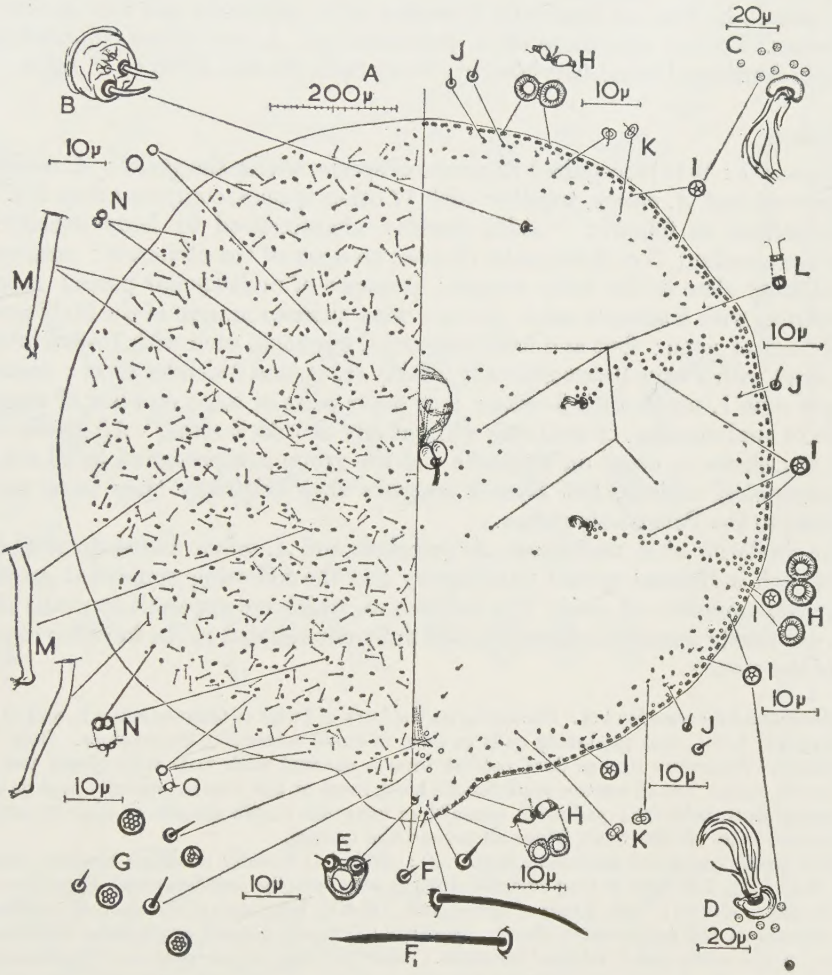


FIG. 3.—*Asterolecanium minus* Lindinger. Adult female shortly before oviposition (from Silwood Park, Berks., on *Quercus robur*). Details as in fig. 1.

accompanying figures represent the actual specimens, accurately drawn using camera lucida ; the females (figs. 1–3) are fully grown at, or shortly before oviposition, and the nymphs (figs. 4–6) at the time of settling. In addition to the material from Silwood Park, the following specimens have been examined (B.M., British Museum (Nat. Hist.) ; K.B., author's own collection) :

A. quercicola : from Cheshire, on oak (B.M., *ex* coll. R. Newstead, 1897, 3 slides) ; Camberley, Surrey, on oak (B.M., *ex* coll. E. E. Green, 1922, 1930 ; 3 slides) ; Bear-

stead, Kent, on oak (B.M., *ex* coll. E. E. Green, no date, 1 slide); Penshurst, Kent, on oak (B.M., *ex* coll. W. J. Hall, 20.x.1945, 4 slides); Sydenham, Kent (K.B., coll. A. Smith, 15.ix.1948); Holkham, Norfolk, on *Quercus robur* (K.B., 2.vii.1959).

A. minus: Essex, on oak (B.M., May, 1935; 1 slide); Fenhurst, Hants, on oak (B.M., *ex* coll. W. J. Hall, 26.viii.1945, 1 slide); Holkham, Norfolk, on *Quercus robur* (K.B., 2.vii.1959).

A. variolosum: Fenhurst, Hants., on oak (B.M., *ex* coll. W. J. Hall, 24.x.1945, 1 slide).

The following *non-British* specimens were also examined: New Zealand, 1 slide (B.M., no date) with *A. quercicola*, on *Q. robur*. Bohemia (Czechoslovakia) 1 slide (B.M., *ex* coll. K. Sulc, no date) with 2 females of *A. variolosum* and 4 of *A. quercicola*, on *Quercus*. Poland, specimens of *A. quercicola* and *A. variolosum* collected by the author in Southern Poland (Grybów, nr. Nowy Sącz, 20.viii.1958) on *Q. robur*.

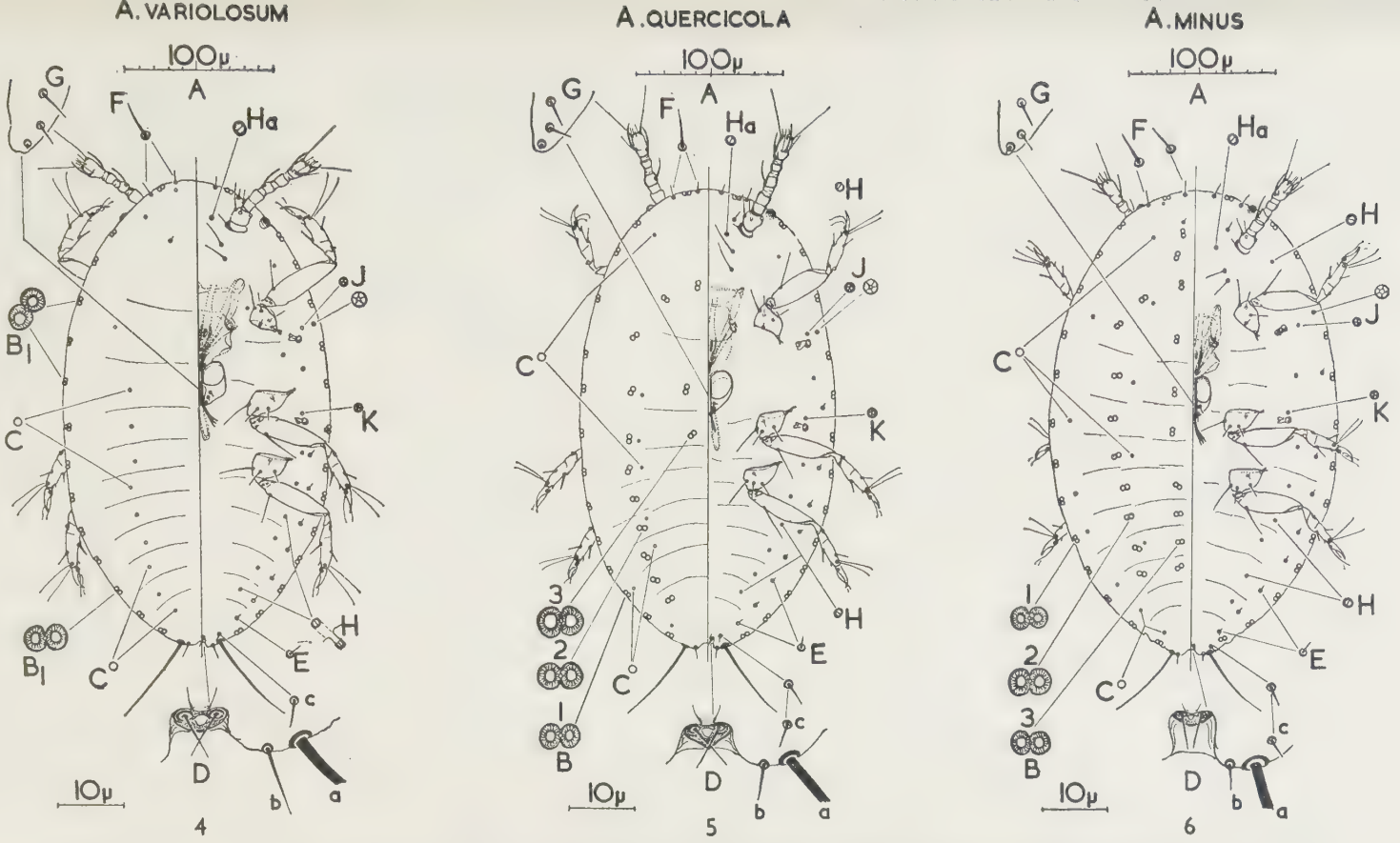
Morphology

Russell (*l.c.*: 8–11) recognized 12 groups of species within the genus; *A. variolosum*, *A. quercicola* and *A. minus*, together with 17 other species, compose group No. III of species defined as follows: "*Adult female:* characterised by body usually being somewhat circular; 3 or fewer pairs of setae on apex of the abdomen; anal opening ventral fairly close to the body margin; presence of multilocular pores; margin of anal opening with 2 setae or none. *Larva:* with anterior margin of the body provided with 2 pairs of setae; first and fourth antennal segments each with 1 seta, fifth with none, sixth with 2 long, 2 stout, usually 2 fairly stout, and 2 slender setae; coxae with 3, femur with 1, tarsus with 2 setae; 3 or fewer pairs of setae on apex of abdomen; margin of anal opening, or anal ring without any or with 2 setae." All species of this group are known to occur on Fagaceae and the group is represented in all six major zoogeographical regions, but Russell suggests that originally they were probably restricted to the Palaearctic region.

The similarity of *A. variolosum*, *A. quercicola* and *A. minus* makes detailed discussion of each individual species unnecessary and the following somewhat generalised description applies to all three. The differences, which are apparent from the illustrations, are briefly discussed afterwards and fully enumerated in the keys for identification of the species.

Habitat and the covering test: Occurring on the bark of twigs of *Quercus robur* L. and *Q. petraea* (Mattuschka) Liebl., and producing galls in form of small crater-like depressions. Only females were found. Immature insects dark reddish-brown, covered with very thin glassy test closely adhering to body; test of mature adult female hard, more or less convex, broadly oval or circular, transparent or translucent; yellowish, greenish or brownish; with smooth or more or less rugose surface, and with whitish waxy fringe all around the margin.

Adult female (mounted specimens, figs. 1–3): *Body* (*A*) broadly ovoid or circular, sometimes wider than long, 780–1606 μ long and 670–1528 μ wide, wholly membranous. Posterior end (*F*) more or less produced; with a pair of *apical setae*, 16–40 μ long, and a pair each of smaller, 5–8 μ long, *interapical* and *anteroventral* setae. *Antennae* (*B*) small, conical or globular tubercles, with 2 stout curved setae and 2 trichoid sensillae. *Beak* globular, apparently one-segmented. *Anal opening* (*E*) small, situated ventrally near posterior margin; *anal ring* irregular, sclerotized, normally with 2, but often with only 1 minute, 3–4 μ long setae at anterior margin. Anterior (*C*) and posterior (*D*) *spiracles* about equal in size, each with wide spiracular bar. *Spiracular bands* of *quinquelocular pores* (*I*) extending from spiracles to margin of body, the bands wide at the margin and gradually narrower towards the spiracles, with a more or less distinct group of 4–16 pores near spiracular opening; total number of pores in spiracular bands varies from 21 to 96 in each, averages and ranges of individual variation being different in each species but with considerable overlap between species; usually more pores present in posterior spiracular band. Some pores larger and have 6–7 loculi. The *8-shaped pores* characteristic of the family present in marginal and submarginal ventral series, and scattered on dorsum. *Marginal pores* (*H*) large, 7–10 μ long and 5–6 μ wide, simple, *i.e.* without sclerotized lateral projection; arranged in a well defined regular single row extending all around margin of body except between apical setae; all pores with long axis parallel to margin of body. *Submarginal ventral 8-shaped pores* (*K*) small,



FIGS 4–6.—*Asterolecanium*, first instar nymphs at time of settling (from Silwood Park, Berks., on *Quercus robur*): (4) *A. variolosum* (Ratzeburg); (5) *A. quercicola* (Bouché): (6) *A. minus* Lindinger.

(*A*) dorsal and ventral aspects; (*B*) 1, 2 and 3, marginal, sublateral dorsal and submedian dorsal 8-shaped pores, respectively; (*C*) dorsal simple pores; (*D*) posterior apex of body with anal ring, and with apical (*a*), interapical (*b*) and antero ventral (*c*) setae; (*E*) submarginal ventral setae; (*F*) anterior marginal setae; (*G*) left half of apex of beak with 3 setae; (*H*) ventral 8-shaped pores; (*Ha*) ditto, inter-antennal pair; (*J*) and (*K*) pores at anterior and posterior spiracles, respectively. Scale lines marked 100 μ refer to fig. A, and those marked 10 μ to all details (figs. *B–K*).

about 3 μ long and 2 μ wide, somewhat ill defined, arranged in a submarginal ventral band composed of 2–3 irregular rows of alternately arranged pores. *Dorsal 8-shaped pores* (*N*) well defined, minute, about 3 μ long and up to 2 μ wide, fairly numerous, scattered more or less evenly throughout dorsum. *Tubular ducts* (*M*) conspicuous and numerous, scattered all over dorsal surface of body; 20–34 μ long, with characteristic slightly sclerotized bulge at inner end. *Simple circular pores* (*O*) minute, about 1 μ in diameter, fairly numerous, scattered among tubular ducts and dorsal 8-shaped pores. *Submarginal ventral quinquelocular pores* (*I*) identical with those forming spiracular bands; arranged in a row close to marginal 8-shaped pores, the row partly double where spiracular bands meet margin, and single elsewhere; the row complete laterally, *i.e.* not interrupted between spiracular bands, but often interrupted anteriorly, and ends at some distance behind posterior spiracular band; this distance and anterior gap both showing very wide ranges of individual variation within each species. So called "*dark rimmed*" pores (*L*) with bilocular pore very well defined but small, about 1 μ in diameter, and usually deeply invaginated; arranged in a group around the beak (fig. 3), often also present in numbers in area of spiracles (fig. 2), and in antero-lateral area of abdomen (fig. 1). Perivulval *multilocular pores* (*G*) 4–6 μ in diameter, with 3–6, or 8–10 loculi; total number varies, 0–16, 19–41, 44–69, depending on the species; when sufficiently numerous the pores arranged in 3–4 transverse continuous (not interrupted medially) rows. *Ventral setae* (*G*), among multilocular pores, 3–5 μ long; 2 pairs in posteriormost row of pores, 1 pair each in, or corresponding to, anterior three rows, and 1 pair anterior to these. *Marginal setae* (*J*) smaller, about 3 μ long, arranged in a rather complete series extending all around body.

Second instar nymph not studied in detail; similar to adult female but without vulva, perivulvar pores and tubular ducts.

First instar nymph (figs. 4–6): *Body* (*A*) oval, longer than wide; at time of settling about 300 μ long and 160 μ wide. *Derm* membranous. *Antennae* 6-segmented, with the usual component of setae characteristic for this group of species; third segment the longest and subdivided by semitransparent transverse band. *Legs* well developed, moderately stout (fig. 6), or slender (fig. 4), with very short tibia and rather long, 3–4 times longer, tarsus; claw simple. *Beak* short, irregularly pentagonal, apparently 1-segmented; at apex (*G*) with 3 pairs of gradually reduced setae. *Eyes* simple, on the margin, anterolateral to bases of antennae. Anterior and posterior *spiracles* small, each with stout spiracular bar and an irregular opening; anterior spiracles with one 3-locular and one 5-locular pores (*J*), posterior with only one 3-locular pore (*K*). *Anal opening* (*D*) apico-ventral, more or less invaginated, thus anal lobes somewhat indicated; *anal ring* sclerotized, irregular, with 2 setae, 6–7 μ long, at anterior margin; *anal tube* short. *Apical setae* (*Da*) 50–66 μ long; *interapical* (*Db*) 5–12 μ long, *anteroventral* (*Dc*) 5–7 μ long. *Marginal 8-shaped pores* (B_1), about 6 μ long and 3·5 μ wide, always present; 14 pores on each side of body, arranged in a single longitudinal row, with long axis of pores parallel to margin of body. Similar 8-shaped pores often also present on *dorsum* (figs. 5, 6), arranged in distinct longitudinal *sublateral* (B_2) and *submedian* (B_3) series, the former normally complete, and the latter either complete (fig. 6) or reduced (fig. 5). Minute simple *disc pores* (*C*), one on each side of each abdominal segment and a few in cephalothoracic area, arranged in a single submarginal row (fig. 4), or irregularly, the pores in some segments occurring near the marginal 8-shaped pores (figs. 5 and 6). *Ventral 8-shaped pores* (*H*) very similar to "dark rimmed" pores of adult female, arranged in a submarginal ventral row extending from abdomen to head and composed of one pore on each of abdominal segments 1–6 and a few in cephalothoracic area; the 2 anteriormost pores (*Ha*) situated between bases of antennae distinctly larger. *Body setae* (*E*) about 2 μ long, arranged in a complete submarginal ventral row; 2 pairs of setae (*F*), about 5 μ long, on anterior margin between eyes. Between mouthparts and bases of antennae 2 pairs of setae, about 20 μ long. No setae immediately anterior to marginal 8-shaped pores.

The British material studied differs from Russell's descriptions of the species as follows: *Adult females* of all three species are smaller and their apical setae and tubular ducts shorter; there is also some difference in the condition of the submarginal ventral band of 8-shaped pores in *A. quercicola*. The *first instar nymphs* of *A. minus* show a considerably higher number of dorsal 8-shaped pores in the submedian series which is normally composed of 10 pairs of pores (4–5 according to Russell), although in some specimens a few of the posterior ones may be missing.

The single character by which the *females* of all three species can be easily separated is provided by the number of multilocular pores. The frequency histogram (fig. 7) clearly shows three distinct groups with an approximately normal distribution within each, and with no overlap between them. The frequency distribution of the size of the body and the total number of quinquelocular pores in the spiracular bands is similar

but, although the averages are different in the three species, the ranges of individual variation within each are much wider and there is a considerable overlap between the species. The total number of marginal quinquelocular pores, and of " dark rimmed " pores may show similar behaviour, but these were not studied in detail. *Asterolecanium minus* also differs from the other two species in the following: the smaller number of loculi in the multilocular pores, the shorter tubular ducts and the apical setae, and the smaller marginal 8-shaped pores. The submarginal ventral band of 8-shaped pores, wider in the posterior part, is characteristic of *A. quercicola.*

Two rather distinct forms were found among the specimens of *A. minus*, namely: (*a*) with the *apical setae stout* and short (fig. 3*F*) and with a comparatively larger number of quinquelocular pores in the anterior and posterior spiracular bands (averages

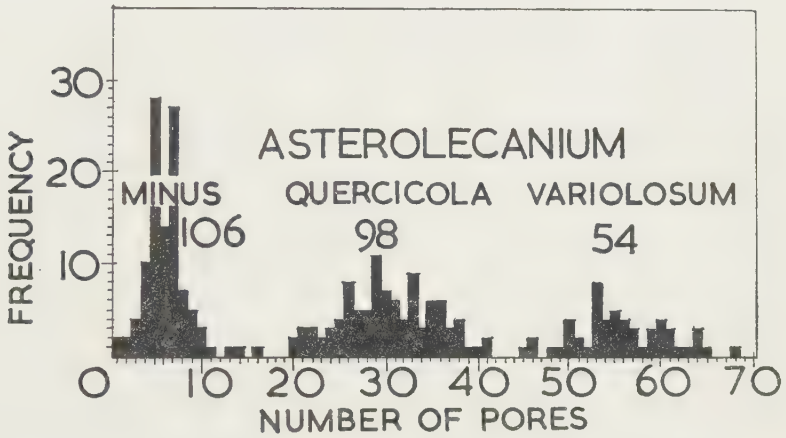


FIG. 7.—Frequency histogram showing number of multilocular derm pores in females of *Asterolecanium minus*, *A. quercicola* and *A. variolosum.*

37 and 40 pores, respectively); and (*b*) with the *apical setae lancet-shaped* and longer (fig. $3F_1$) and with a comparatively smaller number of quinquelocular pores in the spiracular bands (averages 28 and 30 pores, respectively). In the material studied the former form was more numerous (ratio about 3 : 1). Normally these two forms can be easily distinguished, but among 104 specimens examined there were 4 individuals with the intermediate condition, and 2 specimens each with one seta stout and short, and the other lancet-shaped and long.

The *first instar nymphs* differ principally in the condition of the dorsal 8-shaped pores. The size of the marginal 8-shaped pores is approximately the same in all three species (about 6 μ long and 3·5 μ wide); the dorsal pores, if present, are somewhat larger, but in *A. minus* the sublateral (about 6·5 μ long and 4·5 μ wide), and in *A. quercicola* the submedian (about 7·5 μ long and 5 μ wide), are the largest. The setae, notably the apical and anal ring setae, are comparatively long in *A. variolosum* and in *A. quercicola*, while in *A. minus* they are shorter. There are also some differences in the shape and size of the antennae and legs of the three species.

Recognition of the species *in situ* is difficult and not at all reliable; all show great variation in size, shape and colour of the covering test, and the fact that they occur together makes it necessary to mount every single specimen to ensure correct identification. Generally the test of the adult female of a " typical " *A. minus* is small, more or less circular, translucent, dull green or brownish-green, and moderately convex; that of *A. quercicola* is often larger, broadly oval, transparent, green and shiny, often strongly convex; and that of *A. variolosum* is the largest, circular, transparent, yellowish-green or yellow, and rather flat.

Key to adult females

(Figures in brackets are averages)

1 Multilocular pores few, 0–16, usually 4–13 (6·3) pores; each with 4–6 loculi. Tubular ducts 19–23 μ long (20·1 μ). Apical setae 15–34 μ long, usually either stout, 15–24·5 μ long (21·6 μ), or lancet-shaped and 26·5–34 μ long (29·8 μ). Spiracular bands each with 22–55 pores (32·5 pores). Body circular, or nearly so, 780–1107 μ long (909·5 μ), and 670–982 μ wide (843·9 μ). Marginal 8-shaped pores 8–9 μ long and 4–5 μ wide. Dark rimmed pores in a group around the beak. Submarginal ventral band of 8-shaped pores narrow, composed throughout of 2 irregular rows of pores **A. minus** Lindinger (fig. 3)

– Multilocular pores numerous, 19–68 pores, arranged in 4 transverse continuous rows; each pore with 8–10 loculi. Tubular ducts 24–34 μ long (27·0 μ). Apical setae slender, pointed, 31–40 μ long (37·0 μ). Spiracular bands each with 36–95 quinquelocular pores. Body broadly oval or circular, usually larger than as above. Marginal 8-shaped pores 9–10 μ long and 5–6 μ wide 2

2 Multilocular pores 19–41, usually 25–38 pores (31.1). Spiracular bands each with 36–90 quinquelocular pores (59). Body oval or broadly oval, usually longer than wide, 1107–1482 μ long (1264 μ), and 936–1404 μ wide (1116 μ). Submarginal ventral band of 8-shaped pores wider posteriorly, composed there of 3 irregular rows of pores. Dark rimmed pores in a group around beak and in spiracular area . . . . . **A. quercicola** (Bouché) (fig. 2)

– Multilocular pores 44–68, usually 45–65 (56·6) pores. Spiracular bands each with 54–96 quinquelocular pores (77 pores). Body circular or nearly so, sometimes wider than long, 1092–1606 μ long (1388·2 μ), and 951–1528 μ wide (1294·0 μ). Submarginal ventral band of 8-shaped pores uniformly narrow, composed throughout of 2 irregular rows of pores. Dark rimmed pores present in a group around beak, in spiracular area and on antero-lateral area of abdomen . . . **A. variolosum** (Ratzeburg) (fig. 1)

Key to the first instar nymphs

1 Dorsal 8-shaped pores normally absent, occasionally 1–3 pairs present in antero-median area. Apical setae about 65 μ long, interapical about 10 μ, anteroventral about 7 μ, and anal ring setae about 7·5 μ long. Legs and antennae comparatively long and slender . **A. variolosum** (Ratzeburg) (fig. 4)

– Dorsal 8-shaped pores present in sublateral and submedian series; sublateral series always complete and composed of 9–10 pairs of pores, each pore about 6·5 μ long and 4 μ wide; submedian series complete or reduced. Apical and other setae usually shorter than as above 2

2 Submedian series of 8-shaped dorsal pores incomplete, represented by 1–4 pairs of pores in anterior part of dorsum; each pore about 7·5 μ long and 4–5 μ wide. Apical setae about 62 μ long, interapical 7–8 μ, anteroventral 5 μ, and anal ring setae about 7 μ long. Legs and antennae of moderate size **A. quercicola** (Bouché) (fig. 5)

Submedian series of 8-shaped pores normally complete, composed of 10 pairs of pores; some of posterior ones sometimes missing; each pore about 6 μ long and 4 μ wide. Apical setae about 54 μ long, interapical about 6 μ, anteroventral about 5 μ, and anal ring setae about 5·5 μ long. Legs and antennae comparatively short and stout . . . . **A. minus** Lindinger (fig. 6)

Life Cycle

The life cycles of *A. variolosum*, *A. quercicola* and *A. minus* are very similar and can be represented by the following formula, which gives the time at which the particular stages can be found in the field:

E . $\frac{3}{4}$V—$\frac{1}{2}$VI ; N_1 . $\frac{1}{4}$VI—$\frac{3}{4}$VII ; N_2 . $\frac{1}{2}$VII—$\frac{1}{4}$VIII ; F . VIII —W— VI. ♀

Oviposition (E) takes place between the end of May and the beginning of June. The

first crawlers (N_1) hatch before the last eggs are deposited. They settle almost immediately after hatching, and the formation of the pit in the bark is apparent within 24 hours. About the middle of July the settled first instar nymphs begin to moult into the second instar nymphs (N_2), which, in the first half of August, moult directly into young adult females (F). During this short developmental period the increase in size is comparatively small, except in *A. variolosum*, the developmental stages of which appear somewhat earlier and at the time of the second moult the individuals of this species are noticeably larger than those of the other two species. The young adult females grow but little before the winter sets in, and during the winter (—W—) they remain apparently unchanged until March, when growth is resumed. Dissections at that time show that their bodies are full of already formed eggs. In April these begin to show through the skin, and in May the females are filled to capacity with closely packed eggs which are clearly visible through the skin and the hardened test. As oviposition progresses the shrivelling body of the female is gradually pushed forwards until it remains in the form of a compressed narrow crescent at the anterior end of the test. The short period of development explains why casually collected samples usually contain adult females only. These observations agree well with the description of the life cycle of "*A. variolosum*" in Germany by Schmutterer (1952 : 563) ; but the observations in Britain described by Newstead (1903 : 159) are very fragmentary and somewhat inaccurate.

The initial number of individuals settled on terminal twigs is considerable, but within a few weeks most of them disappear and only a few are left. This is apparent from frequent examination in the field of the same twigs, or, at a later stage, from the number of empty, more or less developed pits in the bark of the new growth. No direct observations have been made on the causes of this reduction in the number of specimens, but it is well known that some birds, notably titmice, are very fond of these insects (Betts, 1955, 1956 : Newstead, 1895, 1901 ; 34–36). The adult females are heavily parasitized by hymenopterous parasites, one external, *Aphytis variolosum* Alam, and two internal, *Euaphycus variolosum* Alam and *Psyllaephagus cocci* Alam, described from *Asterolecanium* on oak at Silwood Park (Alam, 1956, 1957).

All three species are considered to be a serious pest on oaks (Borchsenius, 1950), and serious damage to the trees has been reported by Signoret in France (Bois de Boulogne) and particularly by Froggatt in New Zealand, where apparently the European species of Paridae are absent (Newstead, 1903 : 160). The infestation at Silwood Park (and probably in Britain) is low, probably because of the activities of the predators and parasites ; but twigs with several specimens on them are often distorted and their growth reduced. The apparent balance between the insects and their predators and parasites may suggest that the species are indigenous in Britain.

Although all three species usually occur together on the same host tree, the composition of populations on individual hosts varies ; usually one of the species is markedly dominant over the other two. In general, however, *A. variolosum* appears to be the least common. The pattern of distribution of the species within individual populations is not yet clear, but the larger *A. variolosum* is more frequent on new growth and at terminal growing points of twigs, while *A. minus* seems to be more ubiquitous and often occurs in numbers on twigs three or more years old. Schmutterer (1952), discussing "*A. variolosum*" in Germany (Frankonia), noticed that the specimens on young twigs were larger and those on older ones smaller ; he does not mention the other two species and may have used the name *A. variolosum* (Ratzeburg), not as defined by Russell and as here understood, but in its earlier conception, *i.e.* including *A. quercicola* and *A. minus*, all of which were recorded from Germany by Russell (1941).

(References – *see* p. 14)

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ON A REMARKABLE MORDELLID BEETLE FROM NORTHERN RHODESIA[1]

By M. E. Franciscolo

(*Via Pagana Doria* 10–4, *Genoa, Italy*)

Dollmania gen. n.

Belongs to the subfamily Mordellinae, tribe Mordellini. General aspect anaspoid (fig. 1); the body is parallel-sided, its maximum width at middle of elytra. Head narrower than pronotum, definitely wider than long; temporal angle behind eyes obtuse, sharp; temporal edge feebly protruding, in form of a sharp tooth; frons normally convex, without any depression at its middle; occipital margin, seen from behind, perfectly straight; occipital lobe obsolete. Tempora very narrow. Mandibles of normal length. Maxillary palps of male of *Glipodes*-type (type E, *see* p. 216 of the writer's *Monograph of South African Mordellidae* (*South African Animal Life*, **4**: 207–91)), with last segment strongly modified, provided with multiple lobate and ribbon-shaped appendages. Antennae short, hardly longer than palps, moderately serrate from fourth to tenth segments; eleventh segment complete and unmodified. Eyes coarsely granulated, moderately hairy, extremely large, and with broad hypocranial extensions; they cover not less than one half the total cranial surface.

Pronotum normally lobate at its anterior and basal sides, wider than long. Scutellum triangular, small. Elytra without humeral elevations, with the periscutellar area normally flat, without carinations; elytral sculpture of the normal file type; elytra with apices terminating in a wide and regular curve, without any sutural fissure at apex. Epipleura of elytra narrow; metepisterna of the *Mordella*-type, much wider than elytral epipleura.

Pygidium triangular, equilateral, hardly longer than hypopygium, stout; the tip only visible when seen from above.

Anterior tarsi normal, without appendages; median tibiae as long as tarsi; penultimate segment of anterior and middle tarsi slightly wider than third segment, and bilobed; posterior tibiae bearing an extremely short preapical ridge, running parallel to apical row of aculei, and a thin, elevated dorsal ridge; a dorsal ridge of the same type present on tarsal segments 1 to 3; two visible spurs at hind tibiae.

Aedeagus; parameres strongly asymmetrical, of the *Yakuhananomia*-type (type A, *loc. cit.*: 223); penis lanceolate, as long as entire abdomen; eighth sternite complete at apex, not bifurcate.

Type-species: *Dollmania scraptiiformis* sp. n., from Broken Hill, Kashitu, N.W. Rhodesia.

The genus is dedicated to its collector, H. C. Dollman.

Affinities

The affinity of *Dollmania* to the Mordellini, in spite of its apparently aberrant characters, is quite obvious, and, from the structure of the parameres, it appears a rather highly evolved genus. The abnormal structure of the palps is not new in the family; *Glipodes* Le Conte, *Higehananomia* Kôno, *Calycina* Blair in the Mordellini, and *Calyce* Champion in the Mordellistenini have more or less similar features in the last segment of the palps, but that of *Dollmania* shows the most complicated structure so far known in the Mordellidae. The main aberrant characteristic in *Dollmania* is that the entire surface of the last segment of the palps is completely papillate, whereas in the other genera the so-called papillar area is confined to a narrow stripe on the outer side of the segment. The hypocranial extensions of the eyes are similar to those found in *Glipodes* (*cf.* fig. 2, and *loc. cit.*: 214, fig. 3). The atrophic pygidium is a feature that occurs occasionally in the Mordellidae, apparently independently of other characters. The most surprising and unique peculiarity of *Dollmania*, however, is its form, which makes it resemble a Scraptiid rather than a Mordellid (*see* fig. 1).

[1] Contribution No. 40 to the knowledge of Mordellidae.

I suggest the following extension to the key to the genera of Mordellini (to appear in Part 2 of my *Monograph of South African Mordellidae* (*South African Animal Life* **7**, *in press*)) to incorporate *Dollmania*.

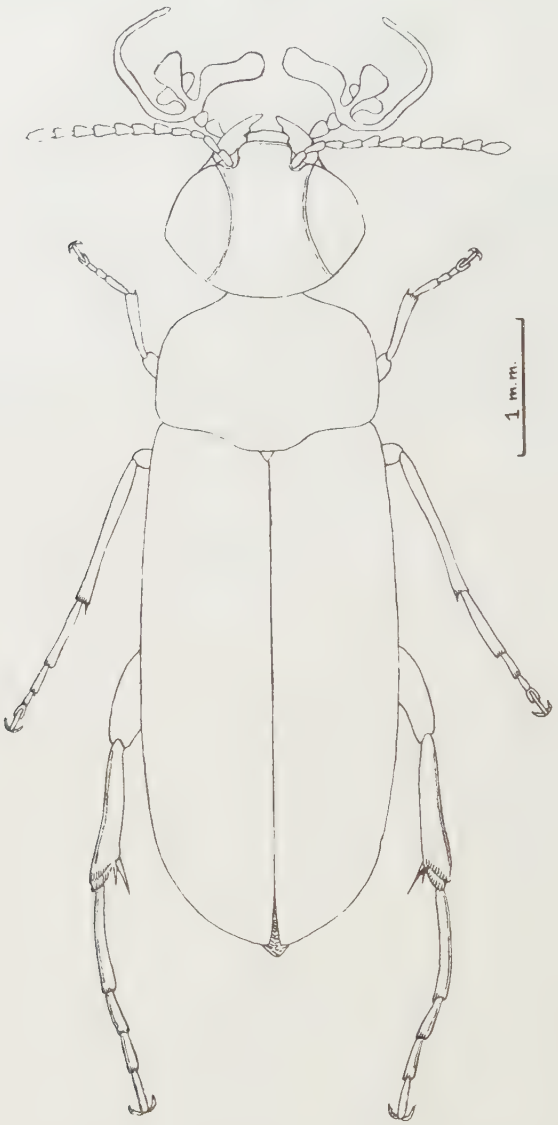


Fig. 1.—*Dollmania scraptiiformis* gen. et sp. n. Diagrammatic view.

52 (3) Last segment of maxillary palps in males with ribbon or lobe-shaped appendages, which, in some instances, entirely replace the segment itself; in females, this segment usually destitute of such appendages, and in the form of a key, more or less strongly emarginate at its anterior side . . . . . Group : **Calycina** Blair

53 (54) Scutellum trapezoidal, or square. One species only so far known (*palpalis* Kôno), one of the largest known Mordellids (10 to 15 mm. long). Island of Formosa

Higehananomia Kôno (1928, *Trans. Sapporo nat. Hist. Soc.* **10** : 30)

54 (53) Scutellum triangular. Average dimensions.

55 (56) Form definitely mordelloid. Eyes very small, with broad temporal areas between themselves and the occiput; with extremely reduced hypocranial extensions, or none at all. Last segment of maxillary palps with ribbon-type appendages, or completely replaced by appendages themselves. Pronotum with enormously developed anterior and basal lobes. Elytra separately rounded at their apices, so that a rather broad sutural fissure is visible at apex. A wet forest genus (Borneo, Malaya, New Guinea, Southern India, Guinea, Congo, Sierra Leone)

Calycina Blair (1922, *Ent. mon. Mag.* **58**: 222–6, 250)
(= *Calycella* Blair, *Calycellina* Pic)

56 (55) Form definitely anaspoid. Eyes unusually developed, covering not less than one half of total cranial area; with very broad hypocranial extensions; tempora completely absent, reduced to a narrow edge behind eyes. Last segment of maxillary palps consists of various lobate appendages and of one ribbon-shaped appendage, all covered by a papillate integument. Pronotum with entirely normal anterior and basal lobes. Elytra not separately rounded at apices, so that sutural fissure at apex is extremely small. North Western Rhodesia

Dollmania gen. n.

Dollmania scraptiiformis sp. n.

N.W. Rhodesia: Kashitu, north of Broken Hill, holotype ♂, labelled "N.W. Rhodesia, Kashitu, N. of Broken Hill, xi.1914, leg. H. C. DOLLMAN—Coll. H. C. DOLLMAN, 1919–79"; in the British Museum (Nat. Hist.).

Dimensions: head 1·4 × 1·65 mm.; pronotum 1·3 × 1·8 mm.; elytra 4·0 × 1·8 mm. (at base) and 2·4 (at two-thirds from base); total length 6·7 mm.; pygidium 1·25 × 1·0 mm.

General form: as figure 1.

Colour reddish-brown; head dark brown, eyes black; antennae completely dark brown; anterior and middle tibiae dark brown; abdomen brown.

Pubescence sericeous, golden, decumbent, uniformly distributed.

Head wider than long (as 8 : 7), convex; the occiput very regularly curved and without traces of abutments or protuberances; temporal angle below eyes well marked, obtuse (about 115°); temporal edge clearly visible and protruding in form of a small hook at vertex of temporal angle. Surface of head very densely punctured; punctures deeply impressed, particularly on pre-occipital surfaces; interstices between them very clearly and transversely shagreened. Other cranial details as in figures 1 and 2. *Maxillary palps* as in figure 3; apex of ribbon-shaped appendage showing arrangement of papillate integument, which covers entire surface of last segment shown in figure 5. *Labial palpi* as in figure 4. *Antennae* (fig. 9) reaching middle of pronotum when folded backwards.

Pronotum much wider than long (as 3 : 2); anterior angles obtuse (about 110°) and broadly rounded at vertex; basal angles square, almost entirely smoothed out; the sides, seen laterally, between anterior and basal angles, appear perfectly straight. The very fine edge beginning immediately after the anterior lobe still visible at level of basal angles, all along outer margin of pronotum. Sculpture of the file type, moderately impressed at centre and gradually deeper along base and sides; interstices rather clearly shagreened. Basal lobe little protruding and complete at its apex.

Scutellum small, triangular, covered by the same pubescence as that of elytra.

Elytra 2·3 times as long as their combined breadth at shoulders; their maximum width, however, at about two-thirds from base; surface very slightly file sculptured, and interstices perfectly glossy, without any trace of shagreen. *Metepisterna* elongate, 2·7 times as long as broad, terminating in a sharp angle at their metacoxal side; their metasternal side feebly convex.

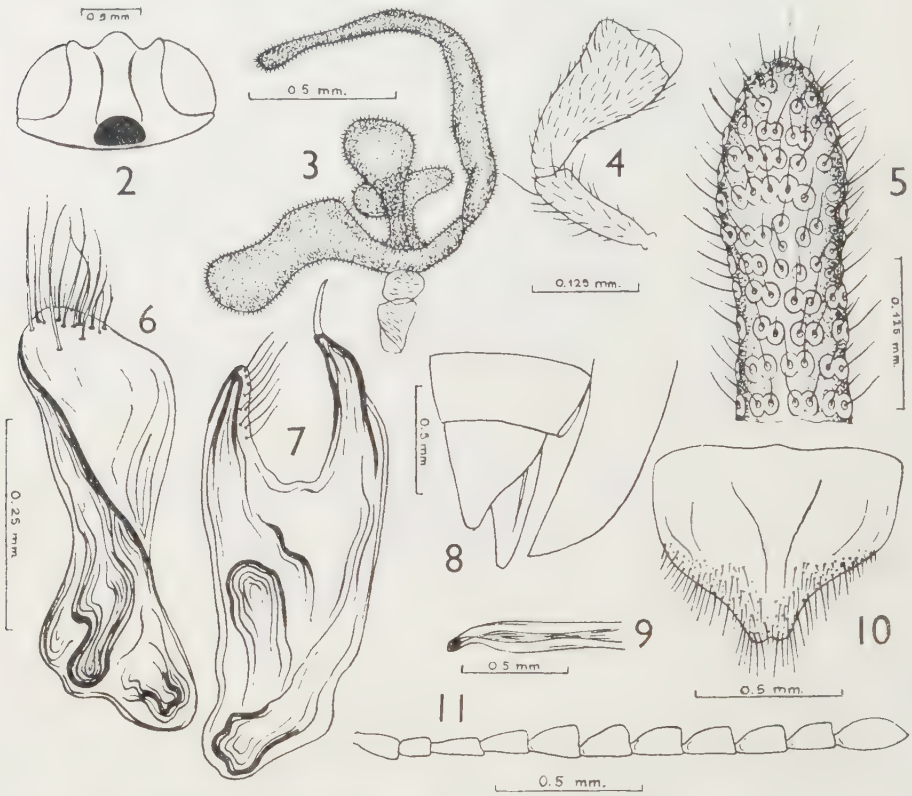
Ratio of abdominal sternites: 10 : 8 : 9 : 9 : 13. *Pygidium* and *hypopygium* represented in figure 8.

Parameres, penis and *eighth sternite* as in figures 6, 7, 9, 10 respectively.

Claws tridentate. *Hind tibiae* with two very unequal apical spurs, the inner twice as long as the outer, both yellow. Dorsal ridge of hind tibiae runs entire length of segment, from knee to

apical row of aculei, and is somewhat elevated and carinate in relation to tibial surface; same occurs also on hind tarsal segments, except onychium. Preapical ridge of hind tibiae unusually small, and confined to a very short row of aculei just behind apical margin of segment.

Tarsal ratios: anterior 5 : 2 : 2 : 2 : 4; middle 15 : 5 : 4 : 2 : 6; posterior 21 : 9 : 9 : 9.



Figs. 2–11.—*Dollmania scraptiiformis* gen. et sp. n.: (2) hypocranium, diagrammatic, to show the large hypocranial extensions of the eyes; (3) last three segments of right maxillary palp; (4) last two segments of left labial palp; (5) tip of ribbon-shaped appendage of last segment of maxillary palp at high magnification to show arrangement of papillary integument; (6) left paramere; (7) right paramere; (8) fourth sternite, hypopygium and pygidium, and apical part of left elytron, seen from left; (9) distal part of penis; (10) eighth internal sternite; (11) right antenna.

ON THE SYSTEMATIC POSITION OF *HEMIMERUS* WALKER—A CASE FOR ORDINAL STATUS

By Edward J. Popham
(*Department of Zoology, The University of Manchester*)

Introduction

Hemimerus talpoides Walker was first discovered in 1871, living on African giant rats of the genus *Cricetomys*, and described by F. Walker, who placed it in the Gryllidae amongst the Orthoptera. Later, Saussure (1879) erected the order Diploglossata to include *Hemimerus*, upon the mistaken assumption (later admitted), that these insects possessed two superimposed labia. Meinert (1880) placed the Diploglossata between the Orthoptera and Thysanura, while Sharp (1892) regarded it as being allied to the Platypsyllidae amongst the Coleoptera—a view which has received little support from later workers. Verhoeff (1902), noting the similarity of the unsegmented cerci to those of earwigs, regarded the Diploglossata as a suborder between the Dermaptera and Blattidae, both of which were, at that time, considered to be members of the Orthoptera. Burr (1911), in separating the earwigs from the Orthoptera as an order, placed *Hemimerus* in a special Dermapteran sub-order, for which he proposed the name "Hemimerina", with equal rank to the Arixeniina and Forficulina. Hansen (1933) reaffirmed this view, which was accepted by Rehn and Rehn (1935) and later by Richards and Davies (1957) in their revision of Imms' *General Text Book of Entomology*. Chopard (1949) regards the Hemimerina as a Dermapteran sub-order, but uses the name Diploglossata.

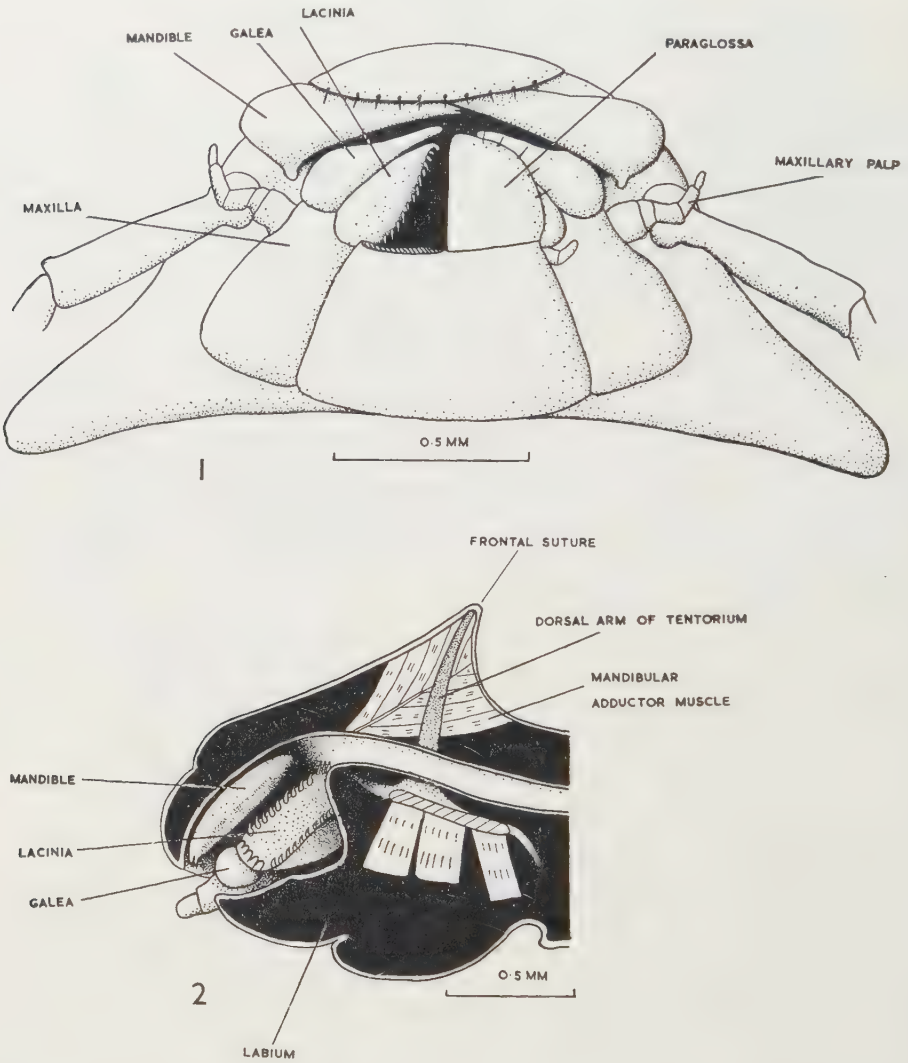
Recent studies of the feeding habits of the Forficulina, Popham (1960) and of *Arixenia* and *Hemimerus* (Popham, *in press*), have shown that the form of the head capsule and the functions of the mandibles and maxillae of *Hemimerus* are fundamentally different from those of the remainder of the Dermaptera. Indeed, the differences are so great that it is necessary to reconsider the systematic position of *Hemimerus* and it is with this matter that this paper is concerned.

Comparison with Dermaptera

Head and mouth parts. (Figs. 1, 2)

It is generally accepted that the hypognathous type of pterygote head is primitive inasmuch as it retains the ventro-lateral position of appendages typical of the ambulatory limbs (Snodgrass, 1935). E. M. Walker's suggestion (1932) that the pterygote head was originally prognathous is untenable so far as the Dermaptera are concerned (Popham, 1960). Henson (1950) and Popham (1960, *in press*) have both shown that the Dermapteran head has evolved from a generalised type, possibly similar to that envisaged by Snodgrass (1928 and 1935), by a longitudinal elongation of the ventral side of the head capsule between the mandibles and maxillae (hypostomal elongation), accompanied by a backward slanting of the plane of the foramen magnum, lateral dilation of the genae and an upward rotation of the anterior end of the head capsule at the level of the frontal sutures. These changes are functionally associated with an elongation of the body of the tentorium and an enlargement of the associated muscles to give increased maxillary mobility for food collecting. In the primitive Forficulina, the mandibles and maxillae play an equal part in food collecting, but in the more specialised earwigs this function tends to be performed mainly by the maxillae. The mandibles are then used mainly to masticate the food and push it backwards and upwards into the oesophagus.

In *Hemimerus*, the respective roles of the mandibles and maxillae are reversed, food being first collected and lacerated by the mandibles (fig. 2) and then passed through the cibarium into the oesophagus by the laciniae (fig. 2) of the maxillae. The head of *Hemimerus* is prognathous, but a comparison with the generalised type of head shows that the functional length of the antero-dorsal surface of the cranium



FIGS. 1–2.—*Hemimerus talpoides* Walker: (1) Ventral view of head showing arrangement of mouth parts (the right paraglossa and the hypopharynx have been removed); (2) median view of right side of head to show relative positions of muscles and form of head capsule.

has been shortened by a transverse dorso-posterior fold at the level of the frontal sutures, thus raising the mouth parts into a prognathous position. At the rear of the cranium the genae form a vertical transverse wall, on the anterior surface of which the mandibular adductor (fig. 2) and abductor muscles originate. The plane of the foramen is vertical, not slanting, as in the Forficulina. In addition to these changes the rear of the head capsule has become greatly enlarged transversely until

the head is over three times as broad as it is long (fig. 1). This causes the mandibular articulation facets to be carried outwards and slightly forwards and the mandibles therefore lie anterior to the maxillae (figs. 1 and 2) and thus become the main organs for food collecting. In *Locusta* and many other Orthoptera the bases of the mandibles, maxillae and labium occur at the same level, but in the Forficulina and *Hemimerus* the mandibles have a more distal position, owing to the elongation of the hypostomal region of the head capsule. A similar separation of the bases of the mandibles and maxillae occurs in the opisthognathous head of *Periplaneta* and the more specialised blattids, but is here accompanied by an elongation of the frons. The fact that the Forficulina and *Hemimerus* both show an elongation of the hypostomal region of the head capsule cannot be taken as evidence for close affinity, especially in view of other differences in the form of the head capsule and methods of feeding. Indeed the heads of the two groups of insects are so dissimilar that they could only have been derived from a common ancestor with a head not unlike that of the generalised type as envisaged by Snodgrass (*loc. cit.*).

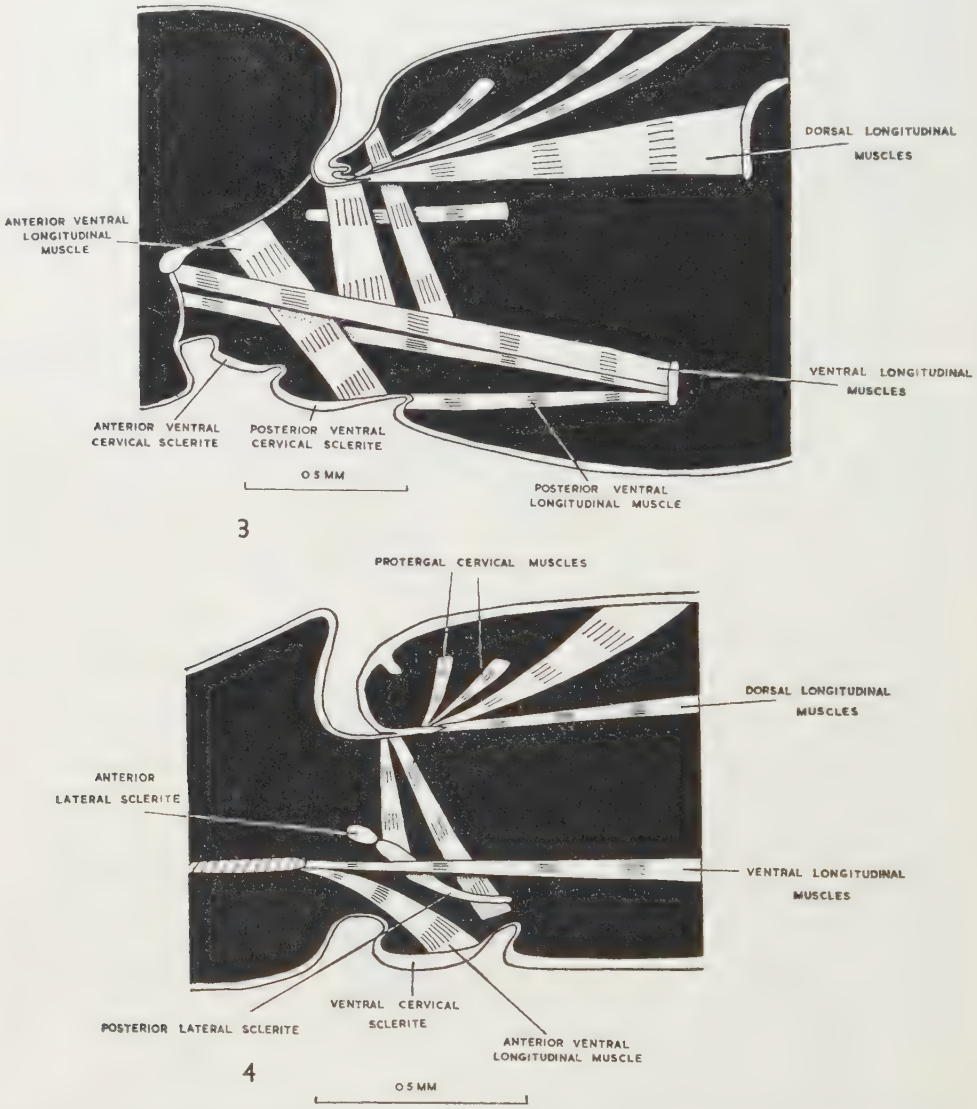
Neck (Figs. 3 & 4)

A study of the Apterygota suggests that the insect neck was originally covered with flexible arthrodial membrane unsupported by any cervical sclerites. In the Orthoptera, this region is laterally strengthened by two pairs of lateral cervical sclerites. Blattids, Mantids, some Plecoptera and all Dermaptera show a further specialisation in possessing two ventral cervical sclerites, for neck support. The primitive subfamilies of the Pygidicranidae have two ventral transverse cervical sclerites, but, with the development of a more prognathous type of head, one or both of these tend to enlarge. In the Diplatyinae, the anterior ventral sclerite enlarges and cervical flexure is mainly restricted to the posterior region of the neck. In the Karschiellinae, both ventral sclerites enlarge to the same degree whereas in the remainder of the Forficulina the posterior ventral cervical sclerite enlarges and cervical flexure mainly occurs near the front of the neck. Moreover, these changes are also associated with a reduction in the lateral cervical sclerites and the formation of a collar-like structure, which allows the neck to become rigid or flexible as circumstances require (Popham, 1960). In no Dermapteran species so far examined is there any tendency for the ventral cervical sclerites to fuse or for one of the sclerites to disappear. *Hemimerus* differs from Dermaptera in having only one ventral sclerite. The lateral cervical sclerites are well developed in *Hemimerus* and, unlike the more specialised members of the Forficulina, there is no collar-like structure in the neck. In *Hemimerus* the arrangement of the cervical muscles is relatively simple: the head being raised and lowered by contraction of the dorsal and ventral longitudinal muscles (fig. 4) respectively. These muscles have similar points of origin and insertion to those in the Dermaptera (fig. 3), Orthoptera and Dictyoptera. The head is turned sideways by contraction of the protergal cervical muscles (fig. 4). The ventral cervical musculature differs from that of the Dermaptera in that there are no posterior ventral longitudinal muscles (fig. 3), while the anterior ventral longitudinal muscles (fig. 4) are inserted on the tentorial bridge mesad to the insertions of the ventral longitudinal muscles, instead of passing outwards between the dorsal and ventral bundles of these muscles (*cf.* figs. 3 & 4). The single ventral cervical sclerite of *Hemimerus* is associated, therefore, with an arrangement of ventral cervical muscles, different from that of the Dermaptera.

Thorax

In the Forficulina the body is dorso-ventrally flattened, the thoracic segments sloping forwards, while the coxae of the legs, though laterally placed, are directed *backwards*. These features, together with the large shield-like pronotum, the

sclerotised front wings or tegmina, under which are normally folded the membranous hind wings, are adaptations to living in litter, under bark or in compact vegetable matter. A similar, though less pronounced, condition exists in the wingless *Arixenia*. In *Hemimerus* there is a well developed pronotum, but the body is dorso-ventrally flattened by a transverse enlargement of the terga and a reduction of the sterna.



FIGS. 3–4.—(3) Median view of right half of neck of *Forficula auricularia* L. to show arrangement of musculature; (4) median view of right side of neck of *Hemimerus talpoides* to show arrangement of cervical musculature.

The coxae, though posteriorly placed on each segment, are directed *laterally*. This method of flattening the thorax is, therefore, fundamentally different from that of the Dermaptera, in which the terga and sterna are of equal width. In *Hemimerus* the legs are not used for pushing the animal through the interstices of various types of vegetable matter, but for running over the body surface of the host. The form of the legs and the laterally directed coxae are adaptations to this method of locomotion.

In *Hemimerus* the leg segments are short and the three jointed tarsi (fig. 5) can be reflexed into a depression on the outer surface of the tibiae. The distal tarsal segment of each leg bears a pair of claws, while the ventral surface of each tarsal segment has a slight depression (fig. 5) lined with numerous small stiff setae, which are probably used to hold on to the surface of the host. The form of the legs, and especially of the tarsi, is highly specialised and bears little resemblance to those of Dermaptera.

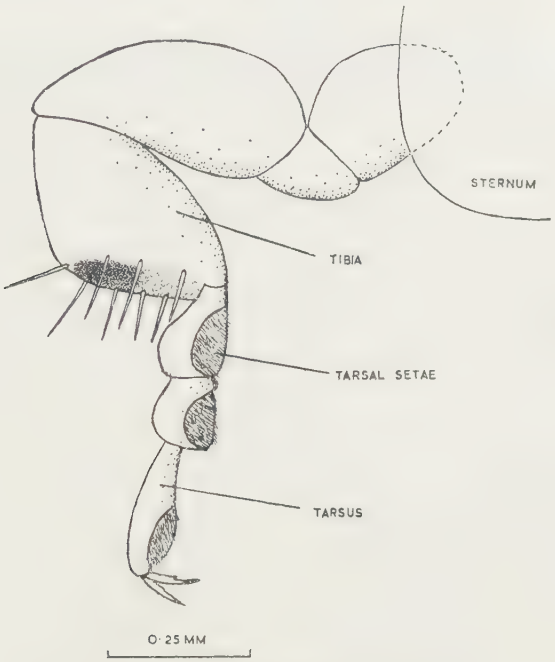


Fig. 5.—*Hemimerus talpoides*, right hind leg.

Abdomen

In the Forficulina the abdomen is dorso-ventrally flattened and the abdominal segments, like those of the thorax, slope forwards. In lateral view, the terga appear to alternate with the sterna, but in *Hemimerus* no such arrangement of the abdominal segment is to be observed, each tergum being dorsal to the sternum of the same segment.

Genitalia

In most Dermaptera and *Hemimerus* the females are devoid of an ovipositor, though gonapophyses are present in the Pygidicranidae. Such a loss is by no means restricted to these insects amongst the Exopterygota. In the primitive members of the Forficulina there are paired penes, but in the more specialised earwigs the structures on the left side tend to be reduced and eventually disappear in the Labiidae and Forficulidae. In *Hemimerus* there is a single penis lobe and there is a tendency for the male genitalia to be displaced towards the left. The existence of a single penis lobe in both *Hemimerus* and the specialised Dermaptera is certainly due to convergence. The existence of an asymmetrical digit-like process on the posterior margin of the ultimate sternite of the abdomen of *Hemimerus*, and the absence of such a structure in the Forficulina, supports this view.

Cerci

Unsegmented cerci exist in both the Dermaptera and *Hemimerus*. In *Forficula auricularia* L. the cerci are well sclerotised, but bear numerous tactile setae. The

presence of large numbers of setae on the cerci of *Hemimerus* is, therefore, a difference in degree rather than of kind. Unsegmented cerci occur not only in the Dermaptera, but also in other orders such as the Plecoptera and Zoraptera. The presence of unsegmented cerci in the Forficulina and the Hemimerina cannot, therefore, be taken as indicative of any close affinity between the two groups of insects.

Conclusion

In view of these fundamental differences between *Hemimerus* and the Dermaptera, the Hemimerina can no longer be regarded as members of that order and the necessity of establishing *Hemimerus* as an independent order must be considered.

Comparison with other Exopterygote Orders

It is reasonable to assume that the hypognathous type of head is a primitive pterygote feature (Snodgrass, *loc. cit.*). This implies that the first winged insects fed upon plant material. From this primitive type of head various independent evolutionary trends can be traced amongst the exopterygote orders.

Blattids are adapted to living in litter, under bark and in similar situations. The head has become opisthognathous and, when flexed under the thorax, is dorsally protected by the broad pronotal shield. These changes in the head are functionally associated with a forward shift in the origins of the maxillary adductor muscles and a posterior shift in the circumoesophageal commissures. The tentorial body is anteriorly enlarged to provide points of origin for the maxillary adductor muscles and there is a small foramen through which the nerve commissures pass. The form of the tentorium in Blattids is, therefore, certainly not primitive, nor is the opisthognathous type of head in which it occurs. Although Mantids have retained a hypognathous type of head, they show specialisations for predation. The eyes are widely separated and the efficiency of stereoscopic vision is thereby increased. In addition, the mandibles have enlarged, the neck has become extremely flexible, the prothorax elongated and the front legs are prehensile.

Amongst the Orthoptera (*sensu stricto*, as used by Richards and Davies, 1957), the Gryllidae show a primitive type of head in which food particles are collected and lifted into the cibarium by the laciniae for mastication by the mandibles. A similar method of feeding occurs in the prognathous heads of Phasmids. Although *Locusta* and other specialised Orthoptera tend to use the mandibles as the main organs of food collecting, the maxillae continue to assist in passing food particles towards the mandibles.

The evolutionary trends shown by each of these orthopteroid insects are fundamentally different from those of *Hemimerus*, outlined above. The form of the head and method of feeding in *Hemimerus* cannot be derived from any of these orthopteroid types except through a common ancestor with a hypognathous type of head and generalised mouth parts.

These conclusions are further supported by considerations of the genitalia and methods of reproduction. The Hemimerina, unlike the Orthoptera and Grylloblattodea, do not possess an ovipositor, and their male genitalia show an asymmetry towards the left, whereas the male genitalia are symmetrical in the Orthoptera and in the Dictyoptera show an asymmetry towards the right, implying different methods of copulation. The combination of a two-lobed ligula, short antennae, single ventral cervical sclerite, three-jointed tarsi and the absence of sclerotised teeth in the gizzard exclude *Hemimerus* from the Dictyoptera, while the similarity in the size of the legs and the absence of tympanal organs would prevent the inclusion of the Hemimerina in the Orthoptera (*sensu stricto*).

Upon these considerations it would appear reasonable to exclude the Hemimerina from the Orthoptera, Blattaria, Mantodea, Grylloblattodea, Phasmida and Der-

maptera, while their specialised mode of life implies evolutionary trends independent of those of the Ephemeroptera, Odonata, Plecoptera, Zoraptera, Embioptera and Isoptera. There now remains only one other possibility, namely to regard the Hemimerina as a separate and independent order of exopterygote insects.

The name Diploglossata Saussure, 1897, for this order of insects, takes priority over Dermodermaptera Verhoeff, 1902, and Hemimerina Burr, 1911. It is a pity that the name was proposed upon a mistaken assumption that the insect has two tongues, while comparison with other exopterygote orders would seem to suggest that the glossae have disappeared. Anomalies of nomenclature are, however, not uncommon in entomology. *Hemimerus* is itself a wingless pterygote insect, while amongst the Hemiptera apterous forms are not unknown, and wingless Hymenoptera such as worker ants are some of the commonest of soil animals. Since there is no provision in the current Rules of Nomenclature for problems involving ordinal names I would, myself, prefer to adopt the name HEMIMERINA, according it ordinal status.

ACKNOWLEDGMENTS

I wish to thank Dr. W. D. Hincks of the Manchester Museum for supplying me with a number of preserved specimens of *Hemimerus talpoides* Walker and for his advice on various points. I also have to thank Miss Gorna who has kindly typed the text.

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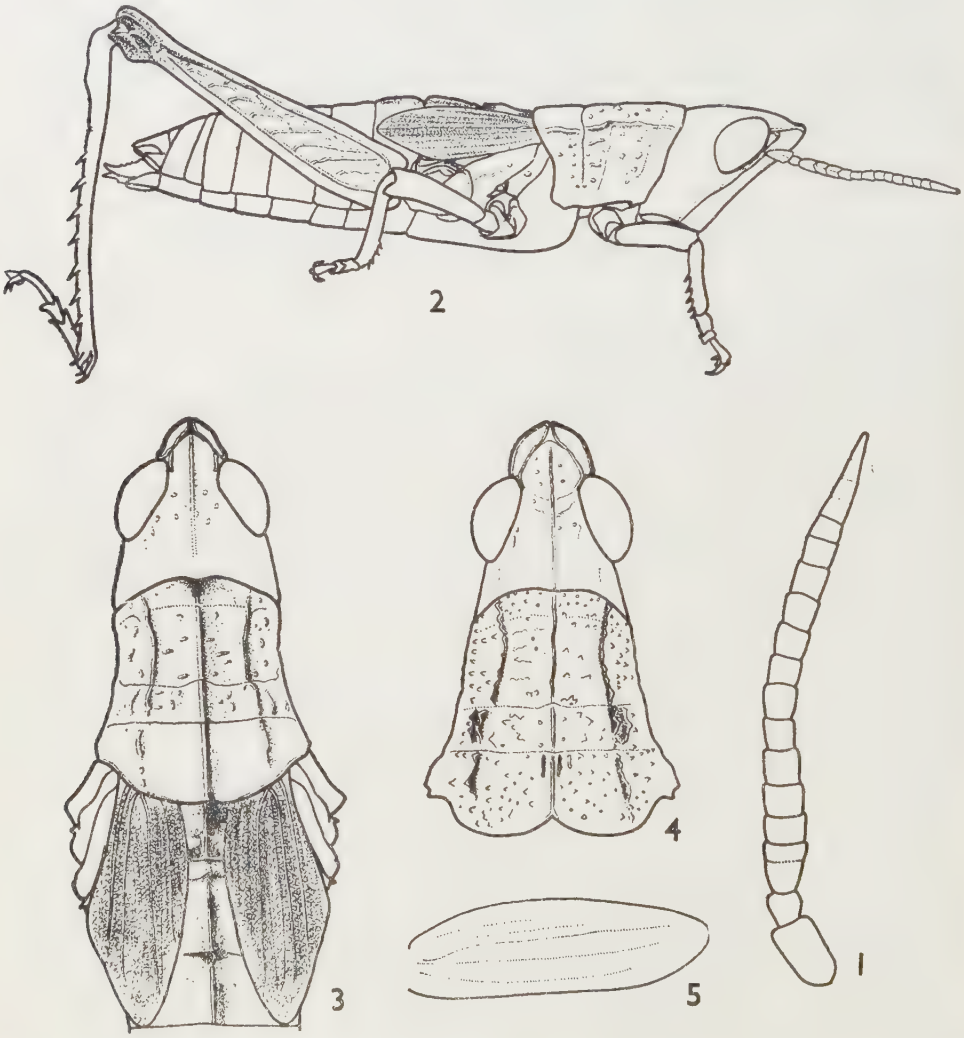
A NEW SPECIES OF THE GENUS *PYRGOMORPHELLA* I. BOLIVAR, 1904 (ORTHOPTERA : ACRIDIDAE) FROM TURKEY

By T. Karabag

(*Zoological Institute, Ankara, Turkey*)

The following new species was collected by me, together with other interesting specimens, in the little-explored south-eastern part of Turkey. It is a country of very high and steep mountains and deep valleys, mostly not easily accessible and I was able to spend only a few hours collecting in the habitat of the new species.



Figs. 1–5.—(1–3) *Pyrgomorphella turcica* sp. n., female : (1) right antenna; (2) lateral view; (3) head, pronotum, metanotum, first and second tergites from above. (4–5) *P. granosa*, female : (4) head and pronotum from above ; (5) left elytron.

Pyrgomorphella turcica sp. n. (Figs. 1–3)

Female (*type*).—Of medium size, robustly built. Antenna shorter than head and pronotum together, first segment very weakly flattened, second rounded, 3–6 triquetrous, rest rounded. Face in profile almost straight, only weakly concave below antenna ; frontal ridge deeply sulcate throughout, but strongly compressed near the fastigium ; lateral carina of the face distinctly curved below the eye ; fastigium of vertex almost as long as its width ; vertex with a distinct median carina extending to about the middle of occiput, and with short parallel lateral carinulae. Surface of head smooth, with two or three indistinct tubercles.

Pronotum weakly convex above in profile ; tubercles scarce, but distinct ; median carina well developed, lateral carina in the first half of pronotum well developed and slightly incurved, in the second half irregular and interrupted. Three transverse sulci ; first very weak above, but distinct on lateral lobes ; second more distinct ; third (typical) sulcus very distinct. Anterior margin distinctly incurved in the middle, posterior margin rounded and shallowly excised in the middle ; lateral lobes longer than high ; metanotum visible, with well developed median carina. Prosternal tubercle low and very small.

Elytron short, lateral, its upper margin rounded, lower margin straight, apex subacute, reaching end of second tergite, completely covering tympanum. Wing very short, reaching a little beyond first tergite.

Hind femur relatively slender, moderately wide near the base, reaching a little beyond apex of abdomen. Tarsal arolium very large, triangular, with rounded apex.

Abdomen with a very distinct median carina, except the first third of first and second tergites. Supra-anal plate parabolic. Cercus conical, base very wide, apex acute.

Ovipositor short, strong, with scarcely serrated upper valves.

Coloration uniformly yellowish light brown (in the paratype with irregular black spots on whole body, except tibiae), sides of head behind eyes with a very pale longitudinal stripe, which continues on to lateral lobes of pronotum ; a wide blackish ring present near apex of antenna.

Measurements : length of body, 16·3 (type)–17 ; pronotum, 3·9 (type)–4 ; elytra, 3·9 ; hind femur, 9 mm.

S. E. Turkey : Hakkari province ; Shemdinli, Gulenk koyu, *ca.* 1000 m., 15.viii.1952, 2 ♀ (including type) (*T. Karabag*).

The genus *Pyrgomorphella* has not been previously recorded from Turkey. The new species is superficially similar to *P. granosa* St. from Palestine, but differs from it in the structure of the head, pronotum (especially its hind margin) and elytra, as can be seen from figures 4–5.

The type is deposited in the British Museum (Natural History) ; paratype in the Zoological Institute, University of Ankara.

Book Notices

The Monarch Butterfly. By F. A. Urquhart. 8vo. University of Toronto Press, 1960. Pp. xxiv + 361, text illust. 52s. 0d.

This work is the result of twenty-three years of research made by the author on the Monarch butterfly, and is a consideration of the biology of this species with special reference to migration ; various factors involved in its life cycle have been included.

The book consists of two parts : the first is a general discussion, with chapters on milkweed, the egg and larva, pupa, the adult butterfly, general considerations and migration, and the second comprises the research data and reference material, arranged under the same headings as the first.

The work has a bibliography, an index and twelve plates in colour, as well as many text figures.

University of California Publications in Entomology. Vol. 16, No. 6. The genus *Laelaps* with a review of the Laelaptinae and a new subfamily Alphalaelaptinae (Acarina : Laelaptidae). By V. J. Tipton. Pp. 233–356, text illust. 8vo. Berkeley and Los Angeles. Price $2.50.

Vol. 16, No. 7. Ethology of some bee- and wasp-killing robber flies of Southeastern Arizona and Western New Mexico (Diptera : Asilidae). By E. G. Linsley. Pp. 357–92, text illust. 8vo. Berkeley and Los Angeles. Price $0.75.

The above works are recent additions to the *University of California Publications in Entomology.* The first is an attempt to bring together the scattered literature on the genus *Laelaps*, an ectoparasite of a group of rodents which carry bacteria and rickettsial infections, and to define its limits on the basis of both morphological characters and ecological data. The sub-family Laelaptinae is also reviewed in an effort to obtain a better understanding of related genera and the higher category to which *Laelaps* belongs. Generic and specific keys are given.

The second work is the result of a study of the foraging habits and behaviour of representatives of several genera of bee-and wasp-killing robber-flies in selected desert habitats where commercial honey-bees were absent. The nature of the mimicry expressed by some of the asilids studied is discussed.

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THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

The Fellowship and Fees

Fellows pay an Admission Fee of £2 2*s*. The Annual Contribution, £3 3*s*., is due on the first day of January in each year, and is payable in advance. Fellows under the age of 25 years on the date of election are exempt from the payment of the Entrance Fee.

Fees should be paid to the Registrar, at 41, Queen's Gate, S.W.7.

Fellows desiring to pay their Annual Contribution through their bankers may obtain an official form of bankers' order by applying to the Registrar.

Fellows whose Contributions for the current year have been paid are entitled to receive the *Transactions* and *Proceedings* of the Society free of charge. Further copies may be purchased at reduced prices by applying to the Registrar.

Forms of application for Fellowship, copies of the Bye-Laws and the List of Fellows may be obtained form the Registrar.

Meetings and Exhibitions

Fellows and others wishing to make a communication to a General Meeting of the Society are requested to send in their names, the title of their exhibit, and a short abstract of their remarks, to the Hon. Secretary fourteen days before the meeting at which it is proposed to make the communication. Should it be desirable to publish a fuller account of the communication the manuscript may be submitted for publication in *Proceedings Series A* or *Series B*.

Fellows resident abroad, or otherwise unable to attend meetings, are reminded that notes or observations sent to the Hon. Secretary may be communicated to a General Meeting on their behalf.

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